

REMARKS

Claims 1-37 are all the claims pending in the application. Claims 24-37 have been withdrawn from consideration pursuant to the Response to Restriction Requirement filed September 27, 2007.

Claims 1 and 24 have been amended to recite “the claimed thick portion being disposed irregularly” in the claimed active layer. Support for these amendments can be found, for example, on page 28, lines 10 to 20 of the specification and Figs. 1 and 2.

No new matter is introduced. Consideration and entry of the amendments are respectfully requested.

II. Rejection under 35 U.S.C. § 103

Claims 1-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication 2005/0026399 A1 to Chien et al. (“Chien”) in view of U.S. Patent Application Publication 2004/0099858 A1 to Lee et al. (“Lee”).

Chien was cited as teaching a substrate, an n-type layer, an active layer, and a p-type layer formed on the substrate, the active layer being sandwiched by the n-type layer and the p-type layer (Office Action, p. 2). The Examiner, however, acknowledged that Chien does not teach an active layer comprising a thick portion and a thin portion, wherein the active layer has a flat lower surface (on the substrate side) and an uneven upper surface so as to form the thick portion and the thin portion (Office Action, p. 2). The Examiner cited Fig. 9, [0052], and [0057] of Lee as teaching a quantum dot active layer 34 said to be within the scope of the claimed active layer.

The reason for rejection was that it would have been obvious to modify Chien's device to employ the quantum dot well layer 34d1 of Lee having a flat bottom surface (on the substrate side) and a thick portion and a thin portion top surface in order to adjust the energy level and the device serves as an optical amplifier.

Applicants traverse, and respectfully request the Examiner to reconsider in view of the amendment to the claims and the following remarks.

First, Applicants submit that Lee does not teach or suggest the element for which the Examiner cites. Lee does not teach a quantum dot active layer within the scope of the amended claims. In particular, Lee teaches quantum dots that are regularly disposed in the quantum dot active layer 34. As shown in FIGS. 9 and 10 of Lee, for example, the quantum dots are disposed at constant intervals. On the other hand, Applicants claim an "active layer comprising a thick portion and a thin portion, the thick portion being disposed irregularly therein." Such thick portions are irregularly disposed in the active layer, as shown in Figs. 1 and 2 and in the description on page 28, lines 10 to 20 of the specification. The active layer of the present invention structurally differs from the quantum dot active layer of Lee in this point.

Second, one of ordinary skill in the art would not have been motivated to combined the references in the manner suggested by the Examiner. The invention disclosed in Lee relates to an optical amplifier (see Title and Abstract of Lee). An optical amplifier is a device for amplifying an input optical signal. Therefore, in the case of a quantum dot active layer in an optical amplifier, a signal light irradiated from one side of the quantum dot active layer is amplified in discontinuous energy levels constituting the quantum dot active layer and then is emitted from the other side thereof (see paragraph [0051] of Lee). The energy level constituting the quantum dot active layer may be adjusted by adjusting the size of a quantum dot (see

paragraph [0052] of Lee). That is, in the optical amplifier the size of a quantum dot in the quantum dot active layer is adjusted to amplify the input optical signal.

On the other hand, an optical signal is not input in a light-emitting device. Therefore, it is not necessary to adjust the energy level constituting the active layer in consideration of an input optical signal. The active layer of the light-emitting device is adjusted so that the light-emitting device operates at low voltage while maintaining satisfactory light emission output. Therefore, the knowledge concerning the optical amplifier is not directly applicable to a light-emitting device, such that there is no apparent reason which would lead one of ordinary skill to combine the cited references in the manner suggested by the Examiner.

Third, as described in the Background Art portion of the present specification, a light-emitting device having a quantum dot active layer has been already disclosed in, for example, Japanese Patent Application Laid-Open (kokai) Nos. 10-79501 and 11-354839. However, such light-emitting devices are problematic. That is, since the total area of the light-emitting dots is excessively small with respect to the area where the current flows, the overall emission output with respect to input current is lowered even though the emission efficiency of each light-emitting dot is enhanced. In fact, a light-emitting device having a quantum dot active layer has not come onto the market. Even if the LED disclosed by Chien is combined with the quantum dot active layer disclosed by Lee, a gallium nitride compound semiconductor light-emitting device of the present invention, which operates at low voltage while maintaining satisfactory light emission output, cannot be obtained.

In summary, knowledge concerning an optical amplifier, such as that disclosed by Lee, is not directly applicable to a light-emitting device such that that disclosed by Chien, such that there is no apparent reason which would lead one of ordinary skill to combine the cited

references in the first instance, let alone in the manner suggested by the Examiner. Aside from the above, so as to further distinguish the invention from the prior art, claim 1 has been amended to recite that the thick portion is disposed irregularly in the active layer comprising a thick portion and a thin portion. The amendment to claim 1 clearly distinguishes over Lee which discloses quantum dots regularly disposed in the quantum dot active layer at constant intervals. Thus, the combination of Chien and Lee does not disclose all of the limitations of amended claim 1 so as to patentably distinguish over the cited prior art.¹

Withdrawn method claims 24-37 have been amended to include all of the limitations of device claim 1. Therefore, if claim 1 is found to be allowable, Applicants respectfully request rejoinder of the withdrawn method claims pursuant to MPEP § 821.04.

Withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) and allowance of claims 1-37 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

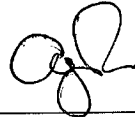
¹ To establish *prima facie* obviousness of the claimed invention, all the claim limitations must be taught or suggested by the prior art. MPEP § 2143.03.

AMENDMENT UNDER 37 C.F.R. § 1.111
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Respectfully submitted,



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